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EFFECTS OF JOB DISPLACEMENT ON CHILDREN OF SINGLE MOTHERS*

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ABSTRACT

With the recent economic upheaval, understanding the effects of parental job displacement on the lives of children has seldom been more important. Despite a large body of research associating job displacement with subsequent non-employment, earnings losses, job quality declines, poor physical and mental health, family disruption, and social withdrawal among workers, research that focuses on effects of parental job displacement on children's well-being is relatively scarce. Moreover, despite an extensive literature on the relationship between single motherhood and children's outcomes, little is known about how involuntary employment separations among single mothers impact children. Using data from the National Longitudinal Survey of Youth and National Longitudinal Survey's Child-Mother File, and using both regression and matching techniques, we find significant declines in educational attainment and significant increases in depression in young adulthood for children whose mothers were displaced during their childhood. Effects appear to be concentrated when mothers are displaced in school age years; we do not find support for effects of maternal displacement when children are in infancy and preschool ages. Effects are also strongest for children whose mothers had low propensities for displacement.

Keywords: job displacement; single mothers; children; education; depression; propensity score matching;

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1 Introduction

Understanding the effects of parental job displacement on the lives of children has seldom been more important. One in seven children in the U.S. under the age of 18, or 10.5 million children, had an unemployed parent in the first quarter of 2010, a number nearly double those who had an unemployed parent at the end of 2007 before the recent era of economic upheaval (Lovell and Isaacs 2010). An even larger number of children had a parent who experienced a job displacement, a form of involuntary job loss that occurs when firms downsize, restructure, close plants or relocate, often in response to macroeconomic pressures. There is a large body of research associating job displacement with subsequent non-employment, earnings losses, lower job quality, poor physical and mental health, and lower levels of social participation among displaced workers themselves (Brand 2006; Brand and Burgard 2008; Burgard, Brand, and House 2006; Charles and Stephens 2004; Farber 2005). However, research on the effects of displacement on the children of displaced workers is relatively scarce. Thus, while we know that job displacement can be socioeconomically, psychologically, physically, and socially damaging, we know less about the potential damage that parental displacement can do to the lives of their children.

A few recent studies assess the impact of parental job loss on children's outcomes, most often children's academic progress as measured by grade repetition and suspension/expulsion from school (Kalil and Ziol-Guest 2005, 2008; Oreopoulos, Page, and Stevens 2008; Page, Stevens, and Lindo 2009). These studies focus more on fathers' roles as financial heads of the family and the consequences of losing such status than on job

displacement per se. Indeed, the definition of employment separation often includes events not considered job displacements, such as loss of a job due to health conditions. Moreover, studies with a focus on mother-father interactions restrict analyses to stably married couples, treating fathers as the essential component in the displacement equation. As such, these analyses find no impact of mothers' job loss on children's academic progress; however, they do not include single-mother households. Indeed, little work has examined the consequences of job displacement among single mothers.[1]

There is, of course, a large literature on socioeconomic attainment and social-psychological conditions of children who grow up with single mothers [see Crosnoe and Cavanagh (2010) for a recent review]. However, most of this work treats single mothers' labor market experience as a static state: women are either unemployed or employed, each with its associated trials for raising children (Yoshikawa, Weisner, and Lowe 2006). While recent work has taken trajectories of labor force experiences among single mothers more seriously, this work generally treats those career trajectories as permanent and voluntary states. As a result, much of this work, while building in the complexity of work trajectories, faces heady problems of selection bias. As it avoids these problems by natural design, the study of job displacement provides a unique opportunity to assess how socioeconomic hardship among single mothers affects the well-being of children. Displacement not only provides a sounder basis for studying the intergenerational impact of socioeconomic circumstances, but the deep recession currently faced by families also means that a substantial numbers of workers have lost jobs due to macroeconomic conditions rather

[1] A notable exception is the work of Kalil and Ziol-Guest (2005), which we discuss in section 2.
[2] This number was estimated by combining the monthly unemployment statistics with data on the family status of unemployed men and women from the Annual Social and Economic Supplement to

than as a result of voluntary choices. It is thus important to appreciate the fallout the recession may incite for the next generation.

In this study, we examine the effects of job displacement among single mothers on children's subsequent socioeconomic and social-psychological outcomes in young adulthood. We use data from the National Longitudinal Survey of Youth (NLSY), a nationally representative sample of over 6,000 young women who were 14-22 in 1979 and followed through 2008, and from the National Longitudinal Survey's Child-Mother File (NLSCM), which includes over 11,000 children of NLSY women who were followed from 1986 through 2008. We adopt the counterfactual approach to causal inference and compare educational and social-psychological outcomes between children whose single mothers were displaced from their jobs and children whose single mothers were not displaced from their jobs but had the same observed propensity to be displaced. We use both regression and matching techniques. In observational studies, matching and regression are two basic methods for adjusting estimates of causal effects for confounding due to observed covariates that may be correlated with the causal variable and that determine the outcome variable. The use of alternative estimation strategies, one model-based and the other nonparametric, provides a platform from which to assess the robustness of displacement effects to alternative specifications. To study variation in effects, we assess time-varying treatment effects by children's age at the time of maternal displacement (Brand and Xie 2007) as well as heterogeneous treatment effects of maternal displacement by the observed propensity for displacement (Brand 2010; Brand and Davis 2011; Brand and Xie 2010; Xie, Brand, and Jann 2011).

2 Background and Significance

2.1 Incidence of Job Displacement

Waves of job displacement, increasingly widespread job insecurity, and the perceived disappearance of a lifetime job with a single employer for growing segments of the workforce exemplify recent periods of economic reorganization in the U.S. (Farley 1996; Kalleberg 2000, 2009; Levy 1995; Wetzel 1995). Following the severe recession and associated high levels of job displacement in the early 1980s, unemployment persisted at a relatively high rate, average earnings of men stagnated and increased moderately for women, there was no growth in the middle class, no change in the proportion of people in poverty, and there was an increase in income inequality, including an increase in income inequality among families with children (Western, Bloome, and Percheski 2008). In the 1990s through 200s, corporate restructuring became a strategic imperative in order to preserve shareholder value, causing a shift in the social contract between labor and capital such that workers were seen as costs that need to be minimized in an effort to increase profits. There was a growing public perception that the structure of job displacement had qualitatively changed, such that all workers, including highly skilled white collar and educated workers with more tenure, were vulnerable to job loss, reductions in earnings, and prolonged unemployment (Farber 1993a, 1993b).

The period since late 2007 is referred to as the "Great Recession." It is considered by many economists to be the worst financial crisis since the Great Depression of the 1930s. The recession is both deep and broad. Every state in the country, with the exception of a band stretching from the Dakotas south to Texas, shed jobs at a rapid pace. From late 2008 to late 2009, over 6 million jobs were lost. The U.S. unemployment rate hovered around 10

percent throughout 2010 -- the highest rate since 1983 and roughly twice the pre-recession rate. The average number of hours per workweek also declined to 33, the lowest level since the government began collecting the data in 1964. Over 9.4 million families had at least one unemployed member in 2009, up from 6.1 million in 2008. Scholars using simulations estimate that the number of children growing up in poverty may increase by 5 million over the next few years as a result of the recession (Monea and Sawhill 2009).[2] High levels of job displacement and unemployment and the ramifications of these events will undoubtedly persist for some time.

2.2 Job Displacement Effects on Workers

Job displacement is associated with substantial career losses. Most estimates indicate that the average displaced worker experiences a long period of non-employment (Fallick 1996; Farber 2005; Kletzer 1998; Podgursky and Swaim 1987; Ruhm 1991; Topel 1990), a period that lasts longer during recessions than expansions (Farber 1993; Kletzer 1991, 1998). Moreover, the impact of job displacement on careers has been found to be considerable even when workers do not experience long-term or chronic unemployment. Displaced workers suffer substantial earnings losses, estimated to be between 10 and 25 percent, with wage scarring observed as long as ten years after the displacement event occurs (Chan, Sewin, and Stevens 2001; Couch 1998; Fallick 1996; Farber 2005; Jacobson, LaLonde, and Sullivan 1993; Kletzer 1998; Podgursky and Swaim 1987; Ruhm 1991; Seitchik 1991; Topel 1990). As is true for non-employment effects, the degree to which

[2] This number was estimated by combining the monthly unemployment statistics with data on the family status of unemployed men and women from the Annual Social and Economic Supplement to the Current Population Survey.

displaced workers suffer earnings and wage losses is cyclical (Kletzer 1991; Topel 1990) and has a high degree of variance (Seitchik 1991). In a recession like the current one, it is likely that displaced workers are facing longer periods of unemployment and more severe earnings losses. Beyond economic losses, displaced workers may find, when reemployed, that their jobs are of lower quality, in terms of job authority, autonomy, and employer-offered benefits, and in comparison to both the jobs they lost and the jobs held by their non-displaced counterparts (Brand 2006). Assuming they want to be reemployed, displaced workers are forced to search for a new job, disproportionately in periods of economic downturn.

Displacement and unemployment is associated with a number of pressures: reduced income, loss of health and pension benefits, and interruption of asset accrual; new patterns of interaction with family members; restriction of socially-supportive collegial relationships; loss of psychosocial assets including goal and meaning in life, social support, sense of control, and time structure; and personal assessment in relation to societal norms and the stigmatization of unemployment (Jahoda 1982; Jahoda, Lazarsfeld, and Zeisel 1933; Pearlin et al. 1981; Newman 1988). It is therefore unsurprising that a significant association has been found between job displacement and lower levels of self-acceptance, self-confidence, morale, higher levels of depression and dissatisfaction with life, and poor physical health (Brand, Levy, and Gallo 2008; Burgard, Brand and House 2007; Dooley and Catalano 1999; Dooley, Catalano, and Wilson 1994; Dooley, Fielding and Levi 1996; Gallo et al. 2000; Gallo et al. 2006; Jahoda 1982; Kasl and Jones 2000; Kessler, Turner and House 1989; Leana and Feldman 1992; Pearlin et al. 1981; Strully 2009; Turner 1995; Warr and Jackson 1985). Displacement is also associated with disruption of social and family

structures and ties. Displaced workers have significant and long-term lower probabilities of involvement in various modes of social participation, including church groups, youth and community groups (e.g., PTA, youth sports), charitable organizations, and informal social gatherings with friends (Brand and Burgard 2008; Wilensky 1961). The displaced are also more likely to get divorced (Charles and Stephens 2004), and, likely in search of a new job, to be geographically mobile (Oreopoulos, Page, and Stevens 2008).

2.3 Parental Job Displacement Effects on Children

Job displacement has significant, long-term effects on socioeconomic status, psychological well-being, physical health, social participation, and family dynamics. We may reasonably expect these conditions to negatively impact children. First, consider the association of job displacement with downward socioeconomic mobility. Insufficient or unstable work limits families' socioeconomic resources to purchase goods critical for child development, such as schools, housing, food, and safe and cognitively enriched learning environments (Conger and Elder 1994; Duncan and Brooks-Gunn 1997; Kalil and Ziol-Guest 2008). Socioeconomic decline may also dampen children's own attitudes about the value of education and work. Displaced and unemployed parents may rely on public assistance, at least for some period of time, reducing children's socioeconomic attainment (Antel 1992; Hill and Ponza 1984). While periods of unemployment may allow more time to spend with children, the stress associated with financial and employment uncertainty and the time needed to devote to job search will likely reduce the quantity and quality of time spent with children (Brooks-Gunn and Markman 2005; Lareau 2003).

Second, lower levels of physical and psychological well-being associated with displacement can inhibit emotional warmth and increase parents' erratic or punitive parenting practices leading to poor adjustment in children (Elder 1974; Elder, Nguyen, and Caspi 1985; Kessler et al. 1989; McLoyd et al. 1994; McLoyd and Wilson 1990). If displaced parents model despondency and despair, they may foster psychological distress among children. McLoyd (1990) notes "deterioration in the parent's psychological functioning in the context of economic loss or poverty may become a communicable social phenomenon to the extent that the child imitates the symptomatic affect and behavior of the parent" (p. 53). Third, we may expect deleterious consequences for children as a result of the relationship between job displacement and declines in social participation (Brand and Burgard 2008). Families lacking social capital and collective efficacy have children with lower educational and socioeconomic outcomes (Coleman 1988, 1990; Furstenberg et al. 1999; Leventhal and Brooks-Gunn 2000; Sampson, Raudenbush, and Earls 1997; Sampson, Morenoff, and Earls 1999; Sandefur and Lauman 1998). Social support fosters psychological adjustment and protects children from the negative effects of stressful experiences. Lack of structural and normative closure decreases social support for children as well as information and control for parents. If parents become socially disconnected from parents of their children's friends, they miss opportunities to observe the child's actions in different circumstances, talk with other parents about their child, and establish comparable norms.[3]

[3] Job displacement is also associated with divorce (Charles and Stephens 2004), but as we focus on single mothers in this paper, we do not review the link between displacement and divorce, and between divorce and children's outcomes.

Finally, job displacement is associated with geographic mobility. Moving can be stressful for parents, and involves a disruption of social networks. Moving can be stressful for children, particularly if it involves changing schools and making new friends. Several studies link children's geographic mobility -- or at least the change in neighborhood characteristics often associated with geographic change (Jackson and Mare 2009) -- to worse outcomes (Astone and McLanahan 1994; Haveman et al. 1991; McLanahan 1983). Perhaps even more importantly, job loss is associated with home loss via mortgage default and foreclosure, landlord foreclosure, or inability to pay rent, creating stress beyond just geographically relocating in search of a new job. In the current era of economic upheaval, job loss and home loss are intricately linked. The delinquency rate for mortgage loans on residential properties increased to a seasonally adjusted rate of 10 percent of all loans outstanding in early 2010.

There are thus many reasons to expect a link between parental job displacement and children's socioeconomic and social-psychological outcomes. Still, the literature on parental displacement and children is remarkably scarce. Kalil and Ziol-Guest (2008), using the Survey of Income and Program Participation (SIPP), find a significantly higher likelihood of child's grade repetition and suspension/expulsion in families where father's experience involuntary employment separation and where mother's are the primary breadwinners. This study yields interesting results, but is framed less about the impact of job displacement and more about family dynamics related to fathers' loss of relative financial standing in the family. Indeed, the categorization of involuntary employment separation includes events not typically included in definitions of job displacement, such as loss of a job due to health conditions. Given their focus on mother-father interactions, they

limit their analysis sample to stably married couples. They find no impact of mothers' job loss on children's academic progress; however, they do not examine single-mother households.

Oreopoulos, Page, and Stevens (2008), using data from the early 1980s recession in Canada, find that sons whose fathers were displaced have lower earnings and are more likely to receive unemployment insurance and social assistance as adults than similar sons whose fathers were not displaced, particularly among sons whose fathers were in the bottom of the income distribution. Their study is also not framed as a study of the effects of parental job displacement on children's outcomes per se, but rather as a way of isolating the causal effects of fathers' income on sons' income. They restrict their analysis to working fathers and do not include data for working mothers or single mothers. Page, Stevens, and Lindo (2009), using the Panel Study of Income Dynamics (PSID), find effects of parental (head of household) job displacement on income of adult children among children from disadvantaged families and when the displacement occurs in early childhood.[4]

The age of the child at the time of the parental job displacement may interact with the effects of displacement, an issue that again has not received much attention to date. Early childhood environment is important for brain development and for structures that

[4] There are also a few working papers that assess the link between parental displacement and children's outcomes. Using data from Canada, Coelli (2009) links fathers' job losses during adolescence to lower rates of college entry in young adulthood if the job loss occurs when the child is in high school. Rege, Kjetil, and Votruba (2009) estimate how children's school performance is affected by their parents' exposure to plant closure in Norway. They find that in areas with "mediocre" performing labor markets, fathers' exposure leads to a substantial decline in children's grade point average, while mothers' exposure leads to improved school performance. A working paper by Stevens and Schaller (2009), using data from the Survey of Income and Program Participation (SIPP), finds that parental job loss increases the probability that children repeat a grade by about 15 percent. Consistent with prior work in this area, the effects are concentrated among the disadvantaged.

shape future cognitive, social, emotional, and health outcomes (Dahl and Lochner 2005; Duncan and Brooks-Gunn 1997; Duncan, Ziol-Guest, and Kalil 2010; Duncan et al. 1998; Shonkoff and Phillips 2000). Early childhood may therefore be a developmental period especially sensitive to parental job displacement and associated socioeconomic adversity and stress. Low income can limit parents' ability to provide adequate nutrition, health care, and enriching activities especially important during children's formative years. The importance of the family relative to school or peer networks during early childhood makes family circumstances particularly paramount in early years. Conversely, research on divorce has found that the effects of stressful life events on children are intensified when children are making important life decisions (Conley 2005).

2.4 Single Parenthood, Employment Experiences, and Children's Outcomes

A large number of children in the U.S. will spend at least some of their childhood raised by a single mother. There are currently about 13.7 million single parents in the U.S., and those parents are responsible for raising 21.8 million children, or approximately 26% of children under 21. Approximately 84% of custodial single parents are mothers (U.S. Census Bureau 2009). Women who are unemployed, who have lower earnings, and who have lower earnings potential are more likely to be single mothers compared with more advantaged women (Duncan and Hoffman 1985; Edin and Kefalas 2005; Garfinkel and McLanahan 1985; Harris 1993; McLanahan and Percheski 2008; White and Rogers 2000). A large literature links single motherhood to worse educational, socioeconomic, and social-psychological outcomes for children (Amato and Keith 1991; Astone and McLanahan 1994; Coleman 1988; Crosnoe and Cavanagh 2010; Krein and Beller 1988; McLanahan 1985;

McLanahan and Sandefur 1994; Seltzer 1994). Economic deprivation and psychological stress are the most common explanations for this link between single parenthood and children's deleterious outcomes. As single mother households are more likely to be poor, their ability to afford educational toys and games, books, home computers, lessons, and other commodities that facilitate children's academic success is limited. They also live in more disadvantaged neighborhoods with weaker institutions (i.e., schools, child care providers, public libraries, recreational programs and activities, parks, social service providers), low homeownership rates, high residential turnover, social disorganization, and low collective efficacy (Jencks and Mayer 1990; Mayer and Jencks 1989; Pebley and Sastry 2004; Sampson, Morenoff, and Gannon-Rowley 2002; Wilson 1987). Less consistent parenting style and less social control, presumably a product of stress, is another probable link between single motherhood and child well-being (Amato 1987; Astone and McLanahan 1994; Dornbusch et al. 1985; Steinberg 1987).

Attention to the impact of labor market work as it relates to the relationship between single motherhood and children's outcomes has increased, particularly as welfare reform has meant an increasingly large proportion of single mothers in the labor force. Work provides many socioeconomic benefits. However, there are various constraints single mothers face to serving the dual role of nurturer and a provider (Edin and Lein 1997a, 1997b; Hao and Brinton 1997; Harknett 2006; McLoyd et a. 1994; Scott et al. 2001; Yoshikawa, Weisner, and Lowe 2006). If single mothers are in the labor force, they are time-constrained. Children who have less attention, help, and supervision may do worse in school than other children. In addition, lack of parental attention limits fostering of social skills and restricts access to social networks, with consequences for children's social

support and psychological well-being as they age. Single working mothers devise a range of strategies to provide more supervision of their children (Conger and Elder 1994; Edin and Lein 1997a, 1997b; Yoshikawa, Weisner, and Lowe 2006), but these strategies are often associated with additional economic and noneconomic burdens. These issues combined with often unstable and unrewarding work produce a high level of stress among single working mothers.

Often the literature linking single mother's work and children treats labor force participation as a static and voluntary state: women either work or they do not, and whether or not they do so is a matter of choice. Yoshikawa, Weisner, and Lowe (2006) write: "What is missing from this research literature on the effects of work on children? Astonishingly, almost none of the studies on maternal work and children's development examine the impact of changes in maternal work and its conditions on children" (p. 12). A few studies allow single mothers' employment to be dynamic rather than static. Studies that have examined employment trajectories among single mothers find that employment instability mean worse outcomes for children (Kalil, Duniform, and Danziger 2001; Kalil and Ziol-Guest 2005; Yoshikawa, Weisner, and Lowe 2006). Yoshikawa, Weisner, and Lowe (2006) study six work trajectories, including job instability. Kalil and Ziol-Guest (2005) examine single mothers' employment patterns when children are age 14-16 and educational and social-psychological outcomes two years later. Despite capturing the complexity of work heterogeneity among single mothers, this work does not differentiate between voluntary and involuntary employment instability. Studies that allow job instability to include voluntary job changes are faced with significant issues of selection bias. Kalil and Ziol-Guest (2005) and Yoshikawa, Weisner, and Lowe (2006) both

incorporate creative research designs to address selection, but in so doing limit the generalizability of their findings. Estimating the overall effects of involuntary employment separations is an issue of principal importance since the recent Great Recession.

3 Data and Methods

3.1 National Longitudinal Survey of Youth (NLSY) and National Longitudinal Survey's Child-Mother file (NLSCM)

The National Longitudinal Survey of Youth (NLSY) began in 1979 with 6,283 young women who have been surveyed annually through 1994 and biannually through 2008. As of 2008, these women were aged 43-50 and had given birth to over 11,000 children. In 1986, the NLS began a separate survey of the children of the NLSY, the National Longitudinal Survey's Child-Mother file (NLSCM). Data have been collected every two years since 1986 through 2008; new sections were added from 1994 through 2008 as the children enter young adulthood. The children of NLSY women were aged 0-38 in 2008. The NLSY is an underutilized resource for the study of job displacement. It has a short recall period for reporting job losses, from one (in 1984-1994) to two (in 1996-2008) years. NLSY provides detailed characteristics of individuals and jobs before and after job displacement. In contrast to the Panel Study of Income Dynamics (PSID), a widely used nationally representative panel survey for the study of displacement, the NLSY allows distinction between layoffs and firings.

We restrict our sample to women and identify whether or not a woman experienced a displacement from her main job between each survey wave, where displacement is

defined as termination from employment as a result of layoff or plant closing. Prior to 1984, the NLSY grouped layoffs with temporary job endings, and so we do not use data on displacement from those years. In each displacement interval we define the sample as those women who were single. We merge data on women from the NLSY to data on children from the NLSCM and reconstruct displacement indicators from year (1984-2008) to child age (0-17). With our eighteen indicators of displacement by child age, we construct four displacement intervals: age 0-5 (i.e., infancy to preschool years); age 6-11 (i.e., elementary schools years); age 12-17 (i.e., adolescence, or middle to high school years); and age 0-17, to capture any displacement that occurred to mothers during their children's childhood.

3.2 Estimating Displacement Effects

Finding variation in parental socioeconomic status to study its effects on child development that is not biased by parental characteristics is a difficult task (Duncan and Brooks-Gunn 1997; Duncan et al. 1998; Haveman and Wolf 1995). Abrupt changes in socioeconomic conditions provide a sort of "natural experiment" offering a stronger basis for inference than the usual practice of examining the covariation of outcomes with socioeconomic status that may arise from a variety of sources over an indeterminate period of time. Job loss among displaced workers is thought to be relatively exogenous to individual characteristics, providing a unique opportunity to assess the effects of socioeconomic changes relatively free from the threat of selection bias (Brand 2006). Indeed, several recent studies of parental job displacement have used the displacement event as a purer estimate of the effects of parental income shocks on children's outcomes

(Coelli 2009; Page, Stevens, and Lindo 2009; Oreopoulos, Page, and Stevens 2008; Stevens and Schaller 2009). Moreover, two recent studies find little differences in the effects of parental displacement on children's outcomes using several alternative estimation strategies, including OLS and fixed effects, leading them to assert that effects of displacement are not driven by unobserved heterogeneity (Coelli 2009; Stevens and Schaller 2009).

The proposed study will adopt the approach that if we are interested in the effect of displacement on children's outcomes, we must consider two potential outcomes: outcomes for a child who had a displaced mother that are observed and outcomes for the same child had that child's mother not been displaced (Morgan and Winship 2007; Heckman 2005; Rubin 1974). For unit *i*, the treatment effect is defined as the difference between the two potential outcomes in the treatment and control states:

$$\Delta_i = y_i^{d=1} - y_i^{d=0}.$$

That is, we ask whether children who have mothers who were displaced from jobs have outcomes that are different than they otherwise would have been had their mothers not been displaced. The fundamental problem of causal inference is that it is impossible to observe both outcomes for the same child (Holland 1986). Despite it being relatively exogenous, displacement is likely conditioned by factors that are also associated with levels of subsequent child outcomes. If unobserved worker characteristics impact decisions to work at firms that are prone to instability and these characteristics are also correlated with the outcomes of children, the effects of displacement on children will be biased. Or, if firms make decisions regarding whom to displace, there is a danger that it is relatively less

productive workers (e.g., lower levels of motivation and ability) who are also worse parents and have children with worse outcomes.

Since all methods for estimating causal effects are limited in some way or otherwise problematic, a feature of this study will be the comparison of several estimators of causal effects. We estimate simple bivariate models for differences in means of children's outcomes, regression estimates with covariate adjustment for the propensity for maternal job displacement, and propensity score matching procedures where children are matched according to their observed likelihood of having a mother who experienced a displacement event (Rosenbaum and Rubin 1983, 1984; Rubin 1997). All matching estimators take the following general form

$$\hat{TT} = \frac{1}{n_1} \sum_{i}^{n_1} [y_{i,d=1} - \sum_{j(i)}^{J(i)} w_{j(i)} y_{j(i),d=0}],$$

where n_1 is the number of treatment cases, i is the index over treatment cases, $j(i)$ is the index over control cases for treated case i ($j(i)$=1,...$J(i)$), and $w_{j(i)}$ is the scaled weight (with sum of one) that measures the relative importance of each control case. We use kernel matching, such that all control units are used and weighted according to the distance from the estimated propensity score of the target treated unit. There is no clear consensus as to which matching estimator performs best in each application (Morgan and Harding 2006). The purpose of using various methodological approaches is to secure a measure of robustness for our findings regarding the nature of any observed association between displacement and children's outcomes. The key to this identification strategy is the assumption that displacement is an exogenous event that is not correlated with unobservable factors that could affect children's outcomes. Fixed effects models are not

possible for the young adult outcomes we explore because these outcomes are not repeated before and after the displacement interval.

Figure 1 is a directed acyclic graph (DAG), a nonparametric path model that encodes causal dependence, of the effects of maternal job displacement on children's outcomes (Pearl 1995, 2009). The advantage of using nonparametric DAGs is that *f*( ) can be any function. The DAG in Figure 1 indicates the following:

$$f(C_M, PS_M, D_M, HS_C, Col_C, D_{20-24,c}, D_{25-29,c}) =$$

$$f(C_M) f(PS_M \mid C_M) f(D_M \mid PS_M) f(HS_C \mid PS_M, D_M) f(Col_C \mid PS_M, D_M)$$

$$f(D_{20-24,c} \mid PS_M, D_M) f(D_{25-29,c} \mid PS_M, D_M)$$

We therefore assume that characteristics of mothers (C_M) impact the propensity for maternal displacement (PS_M) which in turn impacts maternal displacement (D_M) which then impacts children's outcomes, including high school completion (HS_C), college attendance (Col_C), depression at age 20-24 ($D_{20\text{-}24,C}$), and depression at age 25-29 ($D_{25\text{-}29,C}$).

3.3 Estimating Variation in Displacement Effects

3.3.1 Time-Varying Treatment Effects

As we note above, the age of the child at the time of the maternal job displacement may interact with the effects of displacement on children. To address this, we adopt the conceptual framework of Brand and Xie (2007) to estimate effects of time-varying treatments. In our case, we have a time-varying treatment, displacement across ages during childhood, and single-time outcomes measured in young adulthood. As such, we have a vector of potential outcomes. Adopting the simplifying restriction that maternal

displacement is not repeatable, call it initial maternal displacement, treatment can occur in period d=t, where t =1, 2, 3 corresponding to maternal displacement that occurs at age 0-5, 6-11, and 12-17. For units not treated in the observed periods, we denote them by $d > T$, or units who are not treated in childhood. As we note above, a causal effect entails the comparison of potential outcomes associated with two possible treatment conditions. If loss of a job at time t is one treatment condition, the causal effect will depend upon one's definition of the reference counterfactual treatment condition.

For studying time-variation in treatment effects, the unit at risk for experiencing a treatment at time t has not experienced the event up to t. Potential outcomes associated with treatments at earlier times are no longer relevant and should not serve as reference counterfactuals. If a unit remains untreated at time t, the unit could experience treatment at any time subsequent to t. Thus, the reference is a composite incorporating future counterfactuals. In constructing a composite reference, we remain agnostic about future events and collapse all future paths when assessing the treatment effect at a particular time. We define the composite treatment effect at t on an outcome measured at T as:

$$\Delta_i^{t*} = y_i^{d=t} - y_i^{*d>t},$$

where $y_i^{d=t}$ is the value of the outcome for children with displaced mothers in period $d = t$, t = 1, 2, 3, and $y_i^{*d>t}$ is the value of the composite outcome for the same unit had that unit not been treated to t, where the * indicates that the counterfactual is a composite. We define $y_i^{*d>t}$ as:

$$y_i^{*d>t} = \sum_{h=1}^{T} w_{ih} y_i^{d=h} + w_{T+} y_i^{d>t},$$

where w's are weights, with the following normalization constraint:

$$\sum_{h=1}^{T} w_{ih} + w_{T+} = 1$$

Figure 2 is a flowchart of how we study the time-varying effects of maternal displacement. We begin with all children, and those children's mothers can either be displaced when children are age 0-5 or not displaced; those non-displaced by age 5 can either be displaced at age 6-11 or not displaced; those non-displaced by age 11 can either be displaced at age 12-17 or not displaced. Each transition is associated with a marginal probability weight $p()$ of being treated or $q()$ of not being treated at that particular period.

3.3.1 Heterogeneous Treatment Effects

Our second approach to studying variation in effects of maternal displacement on children's outcomes is to consider heterogeneous effects of maternal displacement by the observed likelihood of having a mother who is displaced from a job (Xie, Brand, and Jann 2011). We use the stratification-multilevel method (SM-HTE). The SM-HTE approach has 3 steps: (1) Estimate propensity scores for each unit for the probability of treatment given a set of observed covariates, $P(d=1|X)$, using logit regression models; (2) Construct balanced propensity score strata (or ranges of the propensity score) where there are no significant differences in the average values of covariates and the propensity score between the treatment and control groups. The underlying assumption is that we consider all units within strata, treated and untreated, as homogeneous for estimating treatment effects. While the assumption of within-stratum homogeneity may not hold true in practice, it is less stringent relative to the original homogeneity assumption; (3) Estimate non-parametric propensity score stratum-specific treatment effects within strata or level-1

estimates; and (4) Evaluate a trend across the strata using variance-weighted least squares regression of the strata-specific treatment effects, obtained in step (3), on strata rank at level-2. The objective is to look for a systematic pattern of heterogeneous treatment effects across strata. This strategy has been used in empirical research of the effects of education (Brand 2010; Brand and Davis 2011; Brand and Xie 2010) but never on the effects of job changes.

We also apply a second method for exploring heterogeneity in treatment effects as a sensitivity test to the parametric restriction imposed in SM-HTE. This approach, the matching-smoothing method of estimating heterogeneous treatment effects (MS-HTE), overcomes the assumption of homogeneity within strata in the SM-HTE method. The method consists of the following concrete steps: (1) Estimate propensity score for each unit; (2) Match treated units to control units with a matching algorithm; (3) Plot the observed difference in a pair between a treated unit and an untreated unit against a continuous representation of the propensity score; and (4) Use a nonparametric model to smooth the variation in matched differences to obtain the pattern of treatment effect heterogeneity as a function of the propensity score. That is, we will obtain a non-parametric smoothed curve for the trend in matched differences as a function of the propensity score.

3.4 Measures and Descriptive Statistics

Table 1 describes measures of time-invariant and time-varying covariates that may help predict displacement of mothers. We restrict our sample to mothers who were single at the start of each two-year displacement interval. Grandparents' income is measured as

mothers' total family income in 1979. In 1980, 94% of the NLSY respondents were administered the ASVAB, a battery of ten intelligence tests measuring knowledge and skill in areas such as mathematics and language. We first residualize each of the ASVAB tests on age at the time of the test separately by race and ethnicity. Residuals were standardized to mean zero and variance one. We then construct a scale of the standardized residuals (α = .92) with mean of zero, standard deviation of 0.8, and range of -3 to 3. We also use several variables that we reconstruct from survey year to child age: number of children, whether or not mothers had a non-marital partner, years of education, employer tenure (measured in weeks), and whether or not mothers were manufacturing and trade workers. We measure each of these indicators for mothers when their children were age 0, age 6, and age 12, or in other words, before each displacement interval. Mothers who were displaced are more disadvantaged than mothers who were not displaced on most indicators. They are more likely to be black, they come from more disadvantaged family backgrounds, and they have lower measured ability and fewer years of education. They also have more children and less employer tenure, and are more likely to be in manufacturing and trade industries.

We explore four outcomes for children in young adulthood: high school completion by age 19, some college attendance by age 21, depression at age 20-24, and depression at age 25-29. As reported in Table 1, children with displaced mothers are less likely to complete high school and less likely to attend college. Depression in young adulthood was collected in 1994-2008 and is measured with a 7-item Center for Epidemiological Studies Depression Scale (CES-D) (Radloff 1977) that asked respondents whether they rarely/never, sometimes, occasionally, or most/all of the time: (1) had poor appetite; (2)

had trouble keeping their mind on tasks; (3) were depressed; (4) felt that everything took extra effort; (5) had restless sleep; (6) were sad; and (7) could not get going. We perform factor analyses for each set of items in 1994-2008 and find that the 7 items load onto a single factor in each year. We then construct scales for each year that range from zero to one; alphas range from 0.66-0.74. Finally, we construct two measures that correspond to when children are age 20-24 and age 25-29. As reported in Table 1, children with displaced mothers have higher levels of depression at age 20-24 and 25-29 than children who have mothers who were never displaced.

4 Results

4.1 Effects of Maternal Displacement on Children's Outcomes

The first step in the analysis is to derive estimated propensity scores for maternal displacement for each child in the sample using the set of pre-displacement covariates, the set of time-invariant predictors and those that correspond to children at age 0, before the displacement interval of age 0-17. The results, reported in Table 2, suggest that Black and Hispanic single mothers are significantly more likely to be displaced, as are mothers with parents who had lower family income (i.e., children's grandparents), lower measure ability, and fewer years of education. Employer tenure is protective of displacement as is working in a non-manufacturing industry.

Table 3 reports results on the effects of mothers' job displacement on children's outcomes in young adulthood. We first report bivariate associations, regression with no controls, between our displacement indicator and each of four outcomes. We then report regressions controlling for the estimated propensity for displacement. Each regression is

clustered on mothers and robust standard errors are estimated. We also report propensity score kernel matching results for the average treatment effects on the treated (TT). All results pertain to maternal displacement that occurs anytime when the child is age 0 to 17.

The bivariate associations establish a benchmark to compare to results that control for the propensity for displacement. All fours young adult outcomes are significant. For children whose mothers were displaced, they are 0.75 as likely to complete high school by age 19 (or, about 6 percent less likely) and 0.64 as likely to attend college by age 21 (or, about 10 percent less likely). Children whose mothers were displaced also have a 0.03 higher level of depression than children whose mothers were not displaced at age 20-24 and a 0.04 higher level of depression at age 25-29 (where CESD is on a scale from ranging from 0 to 1, with an overall mean of 0.23 for both age groups). Introducing a control for the propensity mothers are displaced reduces the coefficients from the bivariate associations. However, only high school completion is no longer statistically significant. We continue to find significantly lower likelihood of college attendance (0.75 as likely), as well as higher likelihood of depression at age ranges 20-24 and 25-29.

Matching estimates reported are in close agreement with the regression estimates. Both methods suggest significant reductions in educational attainment and higher levels of depression in young adulthood resulting from maternal job displacement that occurs during childhood. We note that the estimates on educational attainment have different coefficients than the regression estimates because these are matched differences rather than logit coefficients of displacement, but that differences in predicted probabilities from the regressions are substantively similar to the matching estimates.

We estimate t-tests for equality of means in the treated and non-treated groups and the standardized bias both before and after matching, as well as the achieved percentage reduction in bias. The standardized bias is the difference of the sample means in the treated and non-treated (full or matched) sub-samples as a percentage of the square root of the average of the sample variances in the treated and non-treated groups (Leuven and Sianesi, --pstest--; Rosenbaum and Rubin 1985). Our predictors achieve substantial reduction in bias via matching, although there continue to exist some significant differences between predictors. There is a 76 percent reduction in bias for the propensity score between the unmatched and the matched differences.

4.2 Time-Varying Effects of Maternal Displacement on Children's Outcomes

In Table 4, we report kernel matching estimates of the time-varying effects of maternal displacement on children. For the first column labeled "mother displaced child age 0-5," we use a propensity score estimated with a logit regression of displacement age 0-5 on the time-invariant predictors and those predictors that correspond to children at age 0. In the second column labeled "mother displaced child age 6-11," we use the same time-invariant predictors as well as predictors that correspond to children at age 6. And for displaced child age 12-17 the time-varying predictors correspond to children at age 12. As we describe above, we use a composite counterfactual for each treatment period, remaining agnostic as to future displacement events when we estimate effects for a particular treatment period. Those children whose mothers were displaced in previous treatment periods are no longer at risk of initial maternal displacement and are dropped for subsequent comparisons. So for example, for treatment at age 6-11, children whose

mother were displaced at age 0-5 are dropped, and controls include children whose mothers were first displaced at age 12-17.

We find only one marginally significant effect of displacement of mothers when children were 0-5 years old; in this case, the effect is the reverse of the other periods, suggesting a decrease in depression among children whose mothers lost their jobs. By contrast, we find significant effects of maternal displacement when children were 6-11 years old on college attendance and depression at age 20-24 and at age 25-29. For children whose mothers were displaced when they were in adolescence, we find significant effects on high school completion and depression. Effects on educational attainment are thus largest among children whose mothers were displaced when they were 12-17, when they are more likely to be making educational decisions, and greater, or at least comparable effects to adolescence, of displacement on depression among children whose mothers were displaced when they were 6-11.

4.3 Heterogeneous Effects of Maternal Displacement on Children's Outcomes

Average effects of maternal displacement on children's outcomes may conceal underlying systematic effect heterogeneity shaped by the population composition of displaced mothers. To assess effect heterogeneity, we use the SM-HTE method, in which we generate balanced propensity score strata, estimate effects by strata (level-1), and estimate the trends in effects (level-2). Young black mothers with low measured ability who are high school dropouts, who grew up in the south, work in manufacturing, and have only a couple of months job tenure are characteristic of high propensity strata. By contrast, older white mothers with high measured ability who attend college, work outside of manufacturing,

and have at least a year of job tenure are characteristic of low propensity strata (available upon request).

We report heterogeneous treatment effect results in Table 5. The level-2 slopes are significant for all four outcomes, indicating a significant decline in the deleterious effects of maternal displacement as the propensity for displacement increases. That is, the most advantaged mothers have the largest effects of displacement on children's educational and socioeconomic outcomes. There are several significant level-1 slopes among children in strata 1-3, but no significant effects among children in strata 4-5. The effect estimates in strata 1-2 are much larger than the effects we report for the whole population. Levels of children's outcomes by maternal displacement, in contrast to the effects of displacement on outcomes we report in Table 5, are informative. Children whose mothers were displaced and those who were non-displaced have roughly equal relatively low educational attainment and high levels of depression in the high strata. By contrast, children whose mothers were non-displaced have relatively high educational attainment and low levels of depression in the low strata, while children whose mothers were displaced have levels of educational attainment and depression that resemble those children in the high strata. In other words, despite having otherwise relatively advantaged mothers by virtue of their social background and achievements, having a displaced single mother brings children's educational and social-psychological levels more in line with children who have disadvantaged single mothers by virtue of a range of other indicators. For example, depression at age 20-24 is 0.26 among the non-displaced and 0.28 among the displaced in strata 5, while depression is 0.20 among the non-displaced and 0.28 among the displaced in strata 1. Educational attainment is still relatively high among all children in strata 1; here

the distinction is most pronounced in strata 2. As an additional example, 31 percent of the non-displaced and 35 percent of the displaced in strata 5 attend college, while 45 percent of the non-displaced and 34 percent of the displaced in strata 2 attend college.

In order to test the sensitivity of our analysis to the parametric assumption imposed in SM-HTE, we use the matching-smoothing heterogeneous treatment effects method (MS-HTE). Figure 3 presents four graphs that show the local polynomial smoothed curve fit to kernel matched differences between the displaced and non-displaced for each of our four outcomes by estimated propensity scores. That is, the *x*-axis is the estimate propensity for maternal displacement and the *y*-axis is the matched difference between displaced and non-displaced for each outcome. The scatterplot is omitted for simplicity, and the curve represents the nonparametric smoothing to those matched differences. Confirming our results from SM-HTE, each panel shows a roughly linear trend in matched differences by the propensity score: the negative effect of maternal displacement on educational attainment and the positive effect on depression decrease as the propensity for displacement increases.[5]

5 Conclusions

An extensive literature, from Blau and Duncan (1967) to a large literature in sociology and economics, demonstrates the substantial impact of family socioeconomic status on children's life outcomes. The study of parental job displacement adds insight to studies of social stratification and intergenerational mobility by linking macroeconomic

[5] To facilitate implementation of our analyses of heterogeneous treatment effects, we use the Stata modules --hte-- (publically available in Stata, Jann, Brand, and Xie 2010) for SM-HTE and --hte2-- for MS-HTE (described in Xie, Brand, and Jann 2011).

conditions and structured opportunities with parental attainment processes in the intergenerational transmission of socioeconomic status. Job displacement is the result of conditions that are largely beyond the control of parents, and hinders parents' ability to sustain a successful career characterized by upward socioeconomic mobility and to transmit advantages they may have accrued to their children. Studying displacement, we capitalize on a scientific opportunity provided by extreme economic change. Abrupt changes in economic conditions provide a sort of "natural experiment" that may reveal specific mechanisms through which hardships affect children. This is a stronger basis for research than the usual practice of examining the covariation of outcomes with socioeconomic status or poverty, conditions that may arise from a variety of sources over an indeterminate period of time.

Job displacement is a, often unpredictable, precipitating life event that entails a sequence of stressful experiences, from job loss notification, anticipation, dismissal, and unemployment, to (in most cases) job search, retraining and eventual reemployment often in a job of inferior quality and lower earnings compared to the one that was lost. Yet despite the large literature linking job displacement to many deleterious outcomes, there is very little work on how displacement among parents impacts their children. There is even less work on whether the loss of jobs among single parents impacts children. The possibility that children will have adverse socioeconomic effects and model psychological distress resulting from displacement may be heightened in single-parent families because these children typically lack the advantage of an additional parent or other resident adult who may either be employed or at least temper a depressive outlook with a more optimistic and positive style of coping. While the displacement literature is lacking work on

single parents and their children, the literature on single mothers is lacking work that investigates the consequences of involuntary employment separations. Much of this work treats employment status as a static state; studies that explore employment trajectories still allow employment instability to include voluntary transitions.

We fill these gaps in the respective literatures by examining the impact of job displacement among single mothers on children's educational and social-psychological outcomes in young adulthood. We use nationally representative data of women who were followed for the last 3 decades and their children who have been followed for over two decades. Using regression and matching techniques, we find significant effects of maternal displacement on the likelihood children complete high school, attend college, and are depressed as young adults. We also explore variation in the effects of displacement by the child's age at which the mother was displaced and by the probability that the child had a mother who was displaced. Despite developmental theory that might suggest important consequences of negative life events in early childhood, we do not find any negative effects among young children whose mothers were displaced. It may be that the positive effects of women being home to tend to their young children outweigh the negative effects and pressures associated with job loss. We do find large effects among school age children. We may also reason that an income shock would be more damaging to those families with initially low human capital and socioeconomic resources, and thus their ability to "weather the storm" and to secure comparable reemployment. But this conclusion is not supported by our analyses. Our results instead suggest that the shock of displacement to relatively more advantaged single mothers, those with a low likelihood of displacement, yields the largest negative effects of displacement on children. Mothers who have a higher likelihood

of displacement, who are disproportionately black, come from disadvantaged social backgrounds, and have little education, may have come to expect more instability in their lives, and so the effect of displacement is less severe. They may have prepared for income shocks with a social network that can help with temporary financial resources, shelter, or childcare. They also may be more emotionally prepared to deal with such changes, having faced a variety of disadvantaged states.

More conclusions to come …

Next steps: examine mother characteristics (what sort of job is lost (low wage, part-time/full-time; during recession/expansion); genetic matching?; explore a few more child outcomes: job satisfaction and wages in the late 20s;

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Table 1. Descriptive Statistics: NLSY Women (1979-2008) and NLSCM Children (1986-2008)

	Mother *not* displaced child age 0-17		Mother displaced child age 0-17	
	Mean	(SD)	Mean	(SD)
Time-invariant covariates				
Demographic				
Black (0/1)	0.226	(0.418)	0.367	(0.482)
Hispanic (0/1)	0.103	(0.304)	0.113	(0.317)
Mother's socioeconomic background				
Grandparents' income (1979 dollars)	15.588	(11.282)	12.571	(8.676)
Grandparents' intact family age 14 (0/1)	0.648	(0.477)	0.583	(0.493)
Grandparents' southern residence (0/1)	0.351	(0.470)	0.388	(0.480)
Ability				
Mental ability (ASVAB)	-0.133	(0.741)	-0.399	(0.647)
Time-varying covariates				
Time-varying pre-displacement variables, child age 0				
Age	24.761	(5.761)	23.094	(5.028)
Number of children	1.906	(1.229)	2.026	(1.284)
Non-marital partner	0.122	(0.327)	0.200	(0.400)
Years of schooling	12.224	(2.244)	11.538	(1.542)
Employer tenure	20.493	(32.101)	11.451	(23.723)
Manufacturing worker	0.098	(0.297)	0.159	(0.365)
Trade worker	0.165	(0.371)	0.185	(0.389)
Time-varying pre-displacement variables, child age 6				
Age	30.761	(5.762)	29.094	(5.028)
Number of children	2.562	(1.251)	2.623	(1.265)
Non-marital partner	0.131	(0.338)	0.245	(0.430)
Years of schooling	12.393	(2.289)	11.628	(1.543)
Employer tenure	28.488	(43.711)	14.942	(25.425)
Manufacturing worker	0.103	(0.304)	0.174	(0.380)
Trade worker	0.153	(0.360)	0.210	(0.408)
Time-varying pre-displacement variables, child age 12				
Age	36.761	(5.762)	35.094	(5.028)
Number of children	2.804	(1.296)	2.885	(1.288)
Non-marital partner	0.146	(0.353)	0.305	(0.461)
Years of schooling	12.538	(2.302)	11.849	(1.568)
Employer tenure	40.952	(55.625)	23.796	(34.492)
Manufacturing worker	0.095	(0.293)	0.153	(0.360)
Trade worker	0.150	(0.357)	0.237	(0.426)
Child outcomes in young adulthood				
High school completion (0/1)	0.727	(0.446)	0.666	(0.472)
Some college attendance (0/1)	0.445	(0.497)	0.342	(0.475)
CESD age 20-24	0.221	(0.181)	0.262	(0.204)
CESD age 25-29	0.224	(0.190)	0.254	(0.203)
Weighted Sample Proportion	0.91		0.09	

Notes: Sample restricted to children with mothers who were single at the beginning of each two-year displacement interval.

Table 2. Logit Regression Equation Predicting Maternal Job Displacement During Childhood

Black (0/1)	0.760	***
	(0.092)	
Hispanic (0/1)	0.329	**
	(0.108)	
Grandparents' income (1979 dollars)	-0.005	
	(0.005)	
Grandparents' intact family age 14 (0/1)	-0.026	
	(0.080)	
Grandparents' southern residence (0/1)	-0.069	
	(0.083)	
Mental ability (ASVAB)	-0.385	***
	(0.065)	
Age	-0.027	**
	(0.008)	
Number of children	-0.024	
	(0.032)	
Non-marital partner	0.351	***
	(0.100)	
Years of schooling	0.011	
	(0.024)	
Employer tenure	-0.007	***
	(0.002)	
Manufacturing worker	0.773	***
	(0.113)	
Trade worker	0.345	**
	(0.103)	
Constant	-2.229	***
	(0.319)	
$LR\ \chi^2$	233.41	
$P > \chi 2$	0.000	
Sample Size	8877	

Notes: Numbers in parentheses are standard errors. Sample restricted to children with mothers who were single at the beginning of each two-year displacement interval.

† p<.10 * p <.05 ** p < .01 *** p < .001 (two-tailed tests)

Table 3. Regression and Matching Estimates of Maternal Job Displacement During Childhood on Children's Socioeconomic and Social-Psychological Outcomes in Young Adulthood

	Bivariate Association	Regression, Control for PS	PS Kernel Matching, TT
High school completion	-0.283 **	-0.171	-0.039 †
binary 0/1	(0.106)	(0.109)	(0.021)
College attendance	-0.443 ***	-0.290 *	-0.066 **
binary 0/1	(0.116)	(0.120)	(0.022)
CESD age 20-24	0.026 *	0.020 †	0.020 *
scale range 0-1	(0.010)	(0.010)	(0.009)
CESD age 25-29	0.036 **	0.031 *	0.030 *
scale range 0-1	(0.013)	(0.014)	(0.013)

Notes: Numbers in parentheses are standard errors. Propensity scores were estimated by a logit regression model of maternal displacement on the set of pre-displacement covariates. Sample restricted to children with mothers who were single at the beginning of each two-year displacement interval.

† p<.10 * p <.05 ** p < .01 *** p < .001 (two-tailed tests)

Table 4. Matching Estimates of the Effects of Time-Varying Maternal Job Displacement on Children's Socioeconomic and Social-Psychological Outcomes in Young Adulthood

	Mother displaced child age 0-5	Mother displaced child age 6-11	Mother displaced child age 12-17
High school completion	-0.022	-0.022	-0.109 **
binary 0/1	(0.035)	(0.033)	(0.040)
College attendance	-0.027	-0.069 *	-0.132 ***
binary 0/1	(0.038)	(0.034)	(0.040)
CESD age 20-24	0.008	0.036 *	0.020
scale range 0-1	(0.015)	(0.016)	(0.017)
CESD age 25-29	-0.031 †	0.047 *	0.046 *
scale range 0-1	(0.019)	(0.020)	(0.023)

Notes: Numbers in parentheses are standard errors. Results obtained with kernel matching, TTs. Propensity scores were estimated by a series of logit regression models of maternal displacement on the set of pre-displacement time-invariant and time-varying covariates. Sample restricted to children with mothers who were single at the beginning of each two-year displacement interval.

† p<.10 * p <.05 ** p < .01 *** p < .001 (two-tailed tests)

Table 5. Heterogeneous Treatment Effect Estimates of Maternal Job Displacement on Children's Socioeconomic and Social-Psychological Outcomes in Young Adulthood

	Level-1					Level-2
	Strata 1	Strata 2	Strata 3	Strata 4	Strata 5	Trend
High school completion	0.004	-0.109 ***	-0.034	0.076	-0.006	0.047 *
binary 0/1	(0.088)	(0.033)	(0.036)	(0.050)	(0.085)	(0.021)
College attendance	-0.085	-0.116 **	-0.073 †	0.010	0.040	0.050 *
binary 0/1	(0.114)	(0.041)	(0.038)	(0.048)	(0.084)	(0.023)
CESD age 20-24	0.085 *	0.058 ***	-0.005	-0.020	0.017	-0.030 ***
scale range 0-1	(0.040)	(0.015)	(0.015)	(0.022)	(0.040)	(0.009)
CESD age 25-29	0.139 *	0.053 *	0.040 *	0.007	-0.050	-0.035 **
scale range 0-1	(0.055)	(0.023)	(0.019)	(0.026)	(0.040)	(0.012)

Notes: Numbers in parentheses are standard errors. Propensity scores were estimated by a logit regression model of maternal displacement on the set of pre-displacement covariates. Sample restricted to children with mothers who were single at the beginning of each two-year displacement interval.

† p<.10 * p <.05 ** p < .01 *** p < .001 (two-tailed tests)

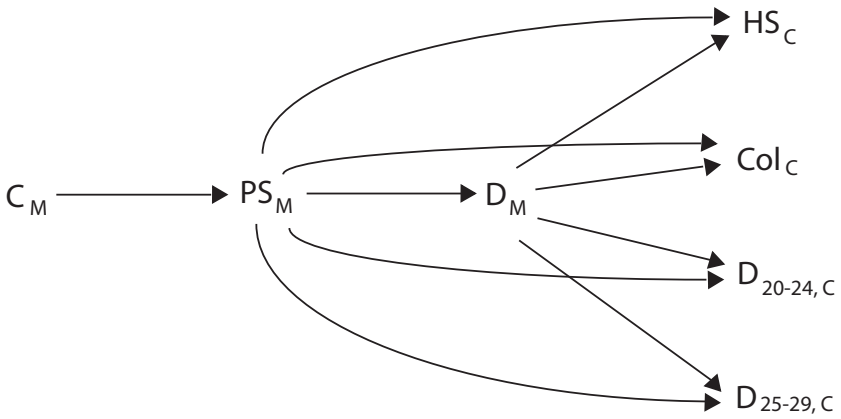

Figure 1. Directed Acyclic Graph (DAG) of Maternal Job Displacement on Children's Outcomes

Key:

C_M :	Covariates – mother
PS_M :	Propensity score for displacement – mother
D_M :	Displacement – mother
HS_C :	High school completed – child
Col_C :	College completed – child
$D_{20\text{-}24,C}$:	Depression, age 20-24 – child
$D_{25\text{-}29,C}$:	Depression, age 25-29 – child

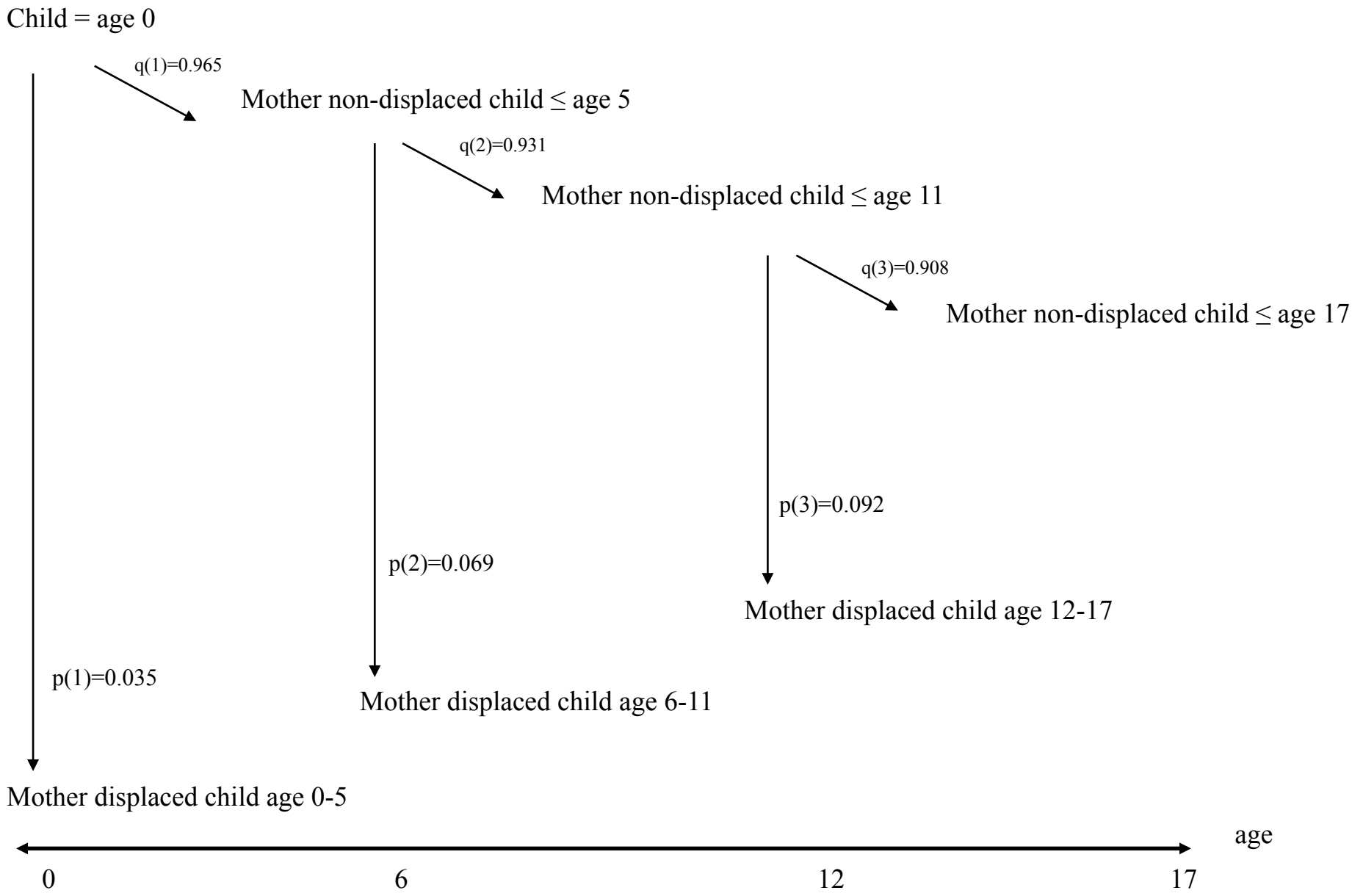

Figure 2. Time-Varying Treatment Flow Chart: Single Mothers' Job Displacement by Children's Ages

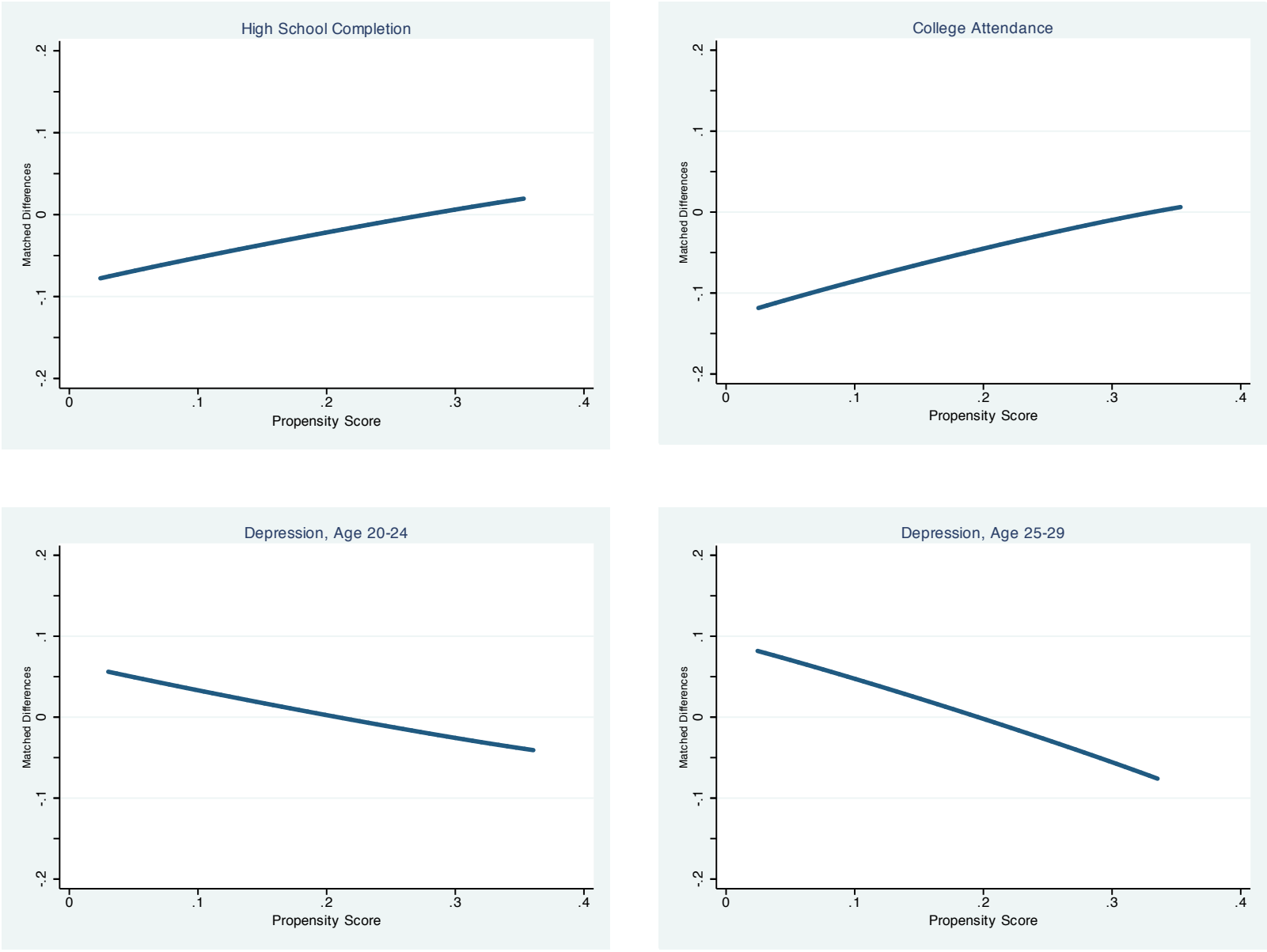

Figure 3. Matching-Smoothing (MS-HTE) Heterogeneous Maternal Displacement Effects on Children's Outcomes